THE TELEGRAPHIC JOURNAL AND

Electrical Review.

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WITH this issue of the Journal commences the tenth volume and also its publication in the form of a weekly newspaper. When this appears before the eyes of our readers, they will be able to judge whether, in making the changes we have deemed advisable to enable us to carry out our programme, we have, in so doing, effected improvements or otherwise. We therefore need not comment further thereon, but will content ourselves with remarking that no effort will be spared to render to our subscribers and friends the fullest information on all matters of interest to Electricians and Telegraph Engineers, and, at the same time, to keep up the high scientific standard which the Journal has hitherto enjoyed.

We desire, however, to suggest to those of our readers who are willing to help us in our work, that they can do so by sending us early information respecting their inventions, "Notes" from the districts in which they reside, and cuttings from foreign and local newspapers.

To the "Correspondence" columns also we would wish to draw attention. With but slight restrictions they are open to all, in which to ventilate questions of import to Electricians, or to those interested in subjects connected in any way with Electricity, either in its theory or in its numerous practical applications. The greater the number of the minds brought to bear on the discussion of any question, the more easily and thoroughly should its difficulties be overcome; and it may frequently happen that the elucidation of one small particle of information may lead to the discovery of an entirely new field of observation. "From smallest things the mind . . . . . may go forward to the knowledge of greater, and climb up from the lowest to the highest things."

THE PRESENT STATE OF ELECTRIC LIGHTING AND ITS PROBABLE TENDENCY IN THE FUTURE.

PERHAPS the first important step in England towards bringing about the rapid development which the electric arc light has attained within the last few years was the public trial of electric lighting by M. Jablochkoff at the West India Docks, in June, 1877. These experiments were at the time considered eminently satisfactory and indicated a great advance in the utilisation of the electric light, for it was shown that several lights could be kept up on one circuit from one machine, and that it was possible to produce an extremely regular electric light from a lamp in which clockwork and mechanism of any kind was dispensed with; and to the Jablochkoff candle must be conceded the honour of being the first to be installed in a practical and successful way, and of exciting the past and present activity of invention in electric lighting and directing public attention to the subject. No other system, in fact, had been brought forward, as far as experiments in street lighting were concerned, at the time of its first appearance on the Thames Embankment and Holborn Viaduct.

For a considerable period no serious competitor appeared in the field, but at the present time the Jablochkoff system is surpassed by several others which have only been brought prominently forward within the last two years. The most successful of these are, the Brush system, which is complete in itself, having machines and lamps, and that of Messrs. Siemens Bros., who also have their own complete apparatus for the production and utilisation of the current. These, together with the system of Jablochkoff, light up nightly a considerable portion of our great city. It is quite unnecessary to specify the districts allotted to each company, as this is already so well known. In addition to these, the Weston machine and lamps are now being used for the illumination of Queen Victoria-street, part of Queen-street, and Southwark Bridge.

For some months experiments of varied character have been tried in this portion of the City, and even now this system has not been very satisfactory, perhaps through no fault of machine or lamps. In many of our metropolitan and country railway stations is installed the electric light in place of the innumerable gas lamps formerly employed, and the effect, it is needless to say, is such as to render these usually very gloomy and depressing places of public convenience almost as bright as during a summer's day.

We believe that at Aldersgate Station, on the Underground Railway, the Weston lamp has been successfully employed, whilst the almost forgotten Lontin system is used at Moorgate-street and Farringdon-street. Several other large towns in the United Kingdom make use of the new illuminating agent for lighting portions of their streets; and what with docks, factories, shops, &c., the electric light has now been so extensively introduced, that it would be tedious to enumerate the various uses to which it is put.

As our intention is to deal chiefly with the lamps employed in connection with the various systems at present in use, it will be well to mention a few of those which have been most successful. Returning to clockwork apparatus, Mr. Crompton's modification of the Serrin lamp has been very prominently brought forward, and, we believe, has been extensively used. This may, perhaps, be due rather to the indefatigable energy of Mr. Crompton than to any striking merit in the lamp itself, which must of necessity be more liable to accident than those in which clockwork is dispensed with. When a slight modification is made in a lamp, and the whole apparatus is then given a new name, one is often apt to forget the original inventor. All honour is due to Serrin for making electric lighting a practicability by means of his lamp, for his lamp and Gramme's machine have been the bases that have enabled present inventions

and improvements to attain the success they have. Another lamp, which is, perhaps, the most successful of any, independently of a complete system such as the Brush or Siemens, is that of Brockie. While other inventors were striving to obtain a good lamp which should be regulated by the strength of the current passing through, and which, from well-known causes, was frequently varying in power, Mr. Brockie happily hit upon the idea of regulating his lamp at stated intervals, thus ignoring the current strength altogether. To do this it was necessary to employ a commutator, worked from the machine or engine, and an extra wire in the circuit, through which a small portion of the current passed at certain fixed periods of time, and released the upper carbon of the lamp; but as a very small wire was sufficient for this purpose, it did not much increase the cost of the apparatus, and this lamp deserves all the success with which it has been favoured.

However, the most perfect arc lamp of all, and indeed one of the most simple kind, has met with but partial success, from what reasons we are unaware. We refer to the lamp invented by M. Rapieff, which has for some years been employed in the office of the *Times* newspaper. M. Rapieff uses, as most of our readers are aware, double carbons inclined to one another at a certain angle. The position of these is determined by their intersection, so that a *constant* length of arc is necessarily produced whatever may be the current strength or irregularity of consumption. These lamps can be used with either continuous or alternating currents, and the invention certainly deserves a foremost place both for its originality and for its simplicity, for in no other lamp in which carbons are used one above the other can a *constant* arc be maintained. Another regulator, not much known in England, but one which will assuredly take a most prominent position, is that known as the "Pilsen." This is electrically the most scientific lamp of any regulated by the current passing through, and it is also very simple in mechanical construction. Many competent judges were of opinion that it was the best lamp in the Electric Light Exhibition recently held in Paris, and undoubtedly its behaviour there was most satisfactory.

The lamps we have mentioned are those which have been used in the majority of electric light installations, and their action generally has been admirable, but all are open to the many objections noticeable in the arc system. The occasional flickering, the rise and fall in the power of the light, its hissing noise, and change of colour, we may assume will never be entirely avoided. The most important and the most practical objection however is the daily visit to each lamp for the purpose of renewing the carbon rods, for although they now burn continuously for sixteen hours or more, the recharging of each lamp constitutes a serious drawback, as it takes a considerable time, and must be done very carefully or failure will result in some instances. However, if it is required to illuminate large spaces free from any obstructions, or divided spaces of considerable dimensions, then it is probable that the arc system will still be employed, and indeed in any place where a very powerful light is required; but we do not think that the problem of street lighting is solved by the use of the electric arc, and of course for indoor illumination of a kind approaching domestic purposes it is out of the question.

The present state of electric lighting by regulators producing the arc is very satisfactory; but it is hardly likely that it will develop to a great extent during future years, for a rival system of lighting, rather ridiculed till lately, but now looked upon with great favour even by those who were formerly its greatest detractors, has come steadily forward during the last twelve months, and may now be considered as likely to claim the attention which has hitherto been devoted almost solely to the electric arc. This is the incandescent system of lighting by electricity. It has long been a favourite idea with inventors, and it appears to offer many advantages over any other. Its simplicity is remarkable; the renewal of the incandescent material whatever it may be is either dispensed with altogether, or some months may elapse before it is necessary to place a fresh lamp in position, and even then the cost is almost nominal. The lamps on this principle may be so perfectly automatic as to require no attention whatever, and there is thus a considerable saving as compared with lamps on the arc system. Up to the present, however, it has been the prevailing notion that lighting by this system required so much more power than was necessary for the arc, that it was hardly worth while considering the question of incandescence at all if economy in working was to be the principal item looked at. This matter of power required was only true to a certain extent, and depended upon the way in which the incandescent lamps were constructed and used; and as even now the proportion of the light produced to the power expended has only once been made the subject of practical trial to any exhaustive extent (thanks to Professors Ayrton and Perry's experiments on the Maxim lamp), it still remains an open question as to the relative economy of lighting by this system and by the voltaic arc. But incandescent lighting will no doubt be brought very nearly equal to that produced by the arc for a certain energy expended and up to a certain candle-power, and the total economy of the newer system will doubtless attain the ascendency; for even should the power expended be greater light for light, it will scarcely be double that expended in the arc, for Professors Ayrton and Perry have worked Maxim lamps up to 1000 and 1100 candles per horse-power, and the saving in material (the carbon rods form a large item in the expenses of the arc system) and attendance will more than compensate for such extra power. The first electrician who seriously considered this mode of illumination appears to have been King, who in 1845 took out a patent for this purpose. He proposed both metallic wires, such as platinum, and carbon, to accomplish his purpose. He also established a vacuum in his globes, and his intention was to use such apparatus for the illumination of mines, powder mills, and any places where the danger of explosion was to be feared; it was also to be applied to submarine purposes. Indeed, King's foresight was most remarkable, his ideas being far before the times in which he lived, and had he been able to produce a cheap and convenient source of electricity, his proposed method would have forestalled most of our present inventions.

A year or two afterwards Petrie used iridium or one of its alloys, and obtained a beautiful light. Although several other inventors devoted much time and thought to the subject, it did not appear to gain ground until Jablochkoff with his kaolin burner, Edison with his iridio-platinum, the Sawyer-Man system, and Werdermann, Reynier, &c., with the semi-incandescent carbon lamps came upon the scene.

The revival of electric lighting by incandescence is, however, due rather to the scientific abilities, energy, and perseverance of Mr. Edison than to any other inventor; for although many detractors of the American electrician have tried their utmost to prove his results to be valueless, he has without doubt by his many exhaustive experiments on incandescent lighting in almost every imaginable form cleared the way for those who now claim priority of invention, and rendered their work comparatively easy, and he has himself achieved as great a success in this new field of electric lighting as any of those systems better known in England. Mr. Edison certainly abandoned the kind of lamp which two or three years since was to revolutionise everything, viz., the iridio-platinum; but this was due to the non-success of his regulating apparatus in preventing the fusion of the wire. We still think that for small lights suitable for domestic use, platinum, iridium, or an alloy will yet be used, and inventors have only to bring forward some simple arrangement for keeping the incandescent material nearly at the point of fusion, but always falling short of that point. There is the advantage attached to a metallic material, that a vacuum is not essential. Mr. Moses Farmer, of Salem, U.S., America, kept platinum lamps within 200 degrees Fahrenheit of their point of fusion for days at a time, and this many years ago, when he had not the facilities for experiment which we can now command. Iridium, which, we believe, is now to be obtained in a malleable form, would, of course, give better results with less risk of fusion, and the alloy of the two

TABLE IV.

EXPERIMENTS ON THE MAXIM INCANDESCENT LIGHT, AT THE CITY AND GUILDS OF LONDON TECHNICAL COLLEGE, FINSBURY.

Ayrton & Perry's Photometer. 89 in. from lamp. Candle-power		Rumford's Method. D = 219·5 values of d in ins.		Candle-power.		Ratio of lens method to Rumford's method.		Mean red.	Mean green.	Amperes.	Volts.	Horse-power.	Candles per horse-power.		Mean candles per horse-power.	Remarks.
Red.	Green.	Red.	Green.	Red.	Green.	Red.	Green.						Red.	Gr'n.		
																Lamp No. I. 26th October, 1881.
35	37	39·2	38·5	31	33	1·1	1·1	33	35	2·42	57	·185	178	189	183	Red measured before green. Observers change places.
31	36	44·0	41·5	25	28	1·2	1·3	28	32	2·42	57	·185	151	173	162	Green before red. Observers change places.
85	106	25·9	21·5	72	104	1·2	1·0	78	105	3·07	67·6	·28	279	375	327	Red before Green. Observers change places.
147	262	18·9	15·2	135	209	1·1	1·25	141	235	3·65	76	·37	381	635	508	Red before green. Lamp observed to be blackening, due to volatilisation of carbon filament.
154	187	16·8	14·8	172	220	0·9	0·85	163	203	3·7	76	·38	429	534	482	Red before green.
246	262	16·8	—	172	—	1·4	—	209	—	4·13	89·1	·5	418	—	—	No green Rumford measurement taken.
—	278	—	14·3	—	237	—	1·1	—	257	4·16	89·1	·5	—	514	—	
206	—	16·0	—	188	—	1·1	—	197	—	—	—	—	—	—	—	This lamp broke on putting on 80 cells.
					Means	1·1	1·1									
		D = 219·5														Lamp No. II. 26th October, 1881.
114	147	24·5	21	80	109	1·4	1·3	97	128	3·01	67·2	·271	358	472	415	
126	203	24	22·5	84	95	1·5	2·1	105	149	3·01	67·2	·271	387	550	468	
220	339	17	15·25	167	207	1·3	1·6	194	258	3·54	78·9	·374	519	690	604	
233	339	18	14·5	149	229	1·6	1·5	191	284	3·54	78·9	·374	511	742	626	
456	647	10·5	9·75	437	507	1·0	1·3	446	577	3·98	86·7	·462	965	1249	1107	Lamp seriously clouding.
351	539	12·5	10·5	308	437	1·1	1·2	329	488	3·98	,,	,,	712	1056	884	,, ,,
317	422	15·5	13·5	201	264	1·6	1·6	259	343	3·98	,,	,,	561	742	651	,, ,,
305	377	16·25	13·0	182	285	1·7	1·5	243	331	3·98	,,	,,	526	716	621	The lamp now broke.
					Means	1·4	1·5									
																Lamp No. III. 26th October, 1881.
228	297	17	14	167	246	1·4	1·2	197	271	3·68	77·7	·383	514	707	610	
438	589	15	11·5	214	364	2·0	1·6	326	476	4·10	86·4	·475	685	1002	843	
438	589	15·25	12·5	207	308	2·1	1·9	322	448	4·10	86·4	,,	678	943	810	
713	790	12	9·5	334	544	2·1	1·5	523	667	4·49	95·0	·571	916	1168	1042	Lamp clouding.
589	713	13	11·0	285	363	2·1	1·9	437	538	,,	,,	,,	765	942	854	,, ,,
598	646	14·5	11·0	230	363	2·6	1·8	414	504	,,	,,	,,	725	883	804	,, ,,
					Means	2·05	1·65									
		D = 225·5														Lamp No. III. 2nd November, 1881.
—	—	22·25	19·5	103	134	—	—	—	—	3·84	86·7	·446	231	300	265	Lamp now broke.
		D = 228														Lamp No. IV. 2nd November.
130	136	25·37	23	81	98	1·6	1·4	106	117	2·94	68·4	·269	394	435	414	Red measurement made first.
228	380	17	14	180	266	1·3	1·4	204	323	3·54	78·9	·374	545	864	704	
380	692	14·5	13·5	247	285	1·5	2·5	314	489	4·24	85·8	·488	643	1002	823	
547	692	10·5	11·5	471	393	1·1	1·7	509	543	4·38	96	·564	902	963	933	
*	973	—	9·5	—	576	—	1·7	—	775	4·8	108	·695	—	1115	—	Lamp now broke.
					Means	1·4	1·7									
									*							Lamp No. V. 2nd November.
1118	—	9	—	641	—	1·8	—	880	—	5	104·4	·7	1257	—	—	Broke after first measurement.

Student reading one of the photometers.

Students reading both photometers.

Students reading both photometers.

Students reading both photometers.

* In order to measure the efficiency of lamp No. V. for high electromotive forces before the clouding, arising from the evaporation of the carbon filament, had taken place, 90 Groves cells, producing a difference of potentials of 104·4 Volts at the two sides of the carbon filament, were at the commencement attached to this lamp. One measurement was taken when the lamp broke.

metals would perhaps be the easiest of all to deal with. However, the attention of all inventors is now turned to the incandescence of the carbon filament inclosed in a vacuum, and Edison, Swan, Lane-Fox and Maxim are all successfully employed in carrying out practically their respective inventions, which differ but slightly from each other technically, the distinction consisting chiefly in the mode employed of fixing the filament into its globe. There is, however, a difference in the sizes and lengths of the filaments employed, for while Swan, Edison, and Lane-Fox use carbons of a cylindrical section, those of Maxim are oblong and somewhat longer, so that the filament contains a greater mass of material than any of the others.

It has been observed that a Maxim lamp requires 25 per cent. more power expended on it to produce a light equal to Swan's, for instance, with a given amount of energy employed. This is undoubtedly true, but only up to a certain candle-power, for although Swan's filament requires less current than Maxim's to produce, say, 30, 40, or 50 candles, yet the latter will stand an amount of current producing 400 or 500 candle-power, whereas a Swan filament would be instantly destroyed. It will be seen, therefore, that any estimate of the value of one system over that of another can only be considered when they are tried under the same conditions. In fact, if inventors wish to get the best effect from their lamps, they should construct their filaments for the particular purposes required. For small lights the filaments might be of a smaller section, or their lengths might be shortened, larger lights require larger carbons, and so on. The nearest approach to the economy of the arc light that we are aware of, from an incandescent lamp, pure and simple, is found in the table of experiments upon the Maxim lamp made by Professors Ayrton and Perry, which we reproduce for the benefit of our readers.

It will be observed that this table has been most carefully and exhaustively compiled, every necessary detail being placed before the reader. It follows that if a filament can be produced to stand the necessary temperature (and we should not like to doubt that this will be accomplished), single incandescent lights may be produced approaching the same illuminating power per horse-power as is now obtained from the electric arc, and without any of the disadvantages that attend the latter. The so-called semi-incandescent lights of Werdermann, Reynier, Joel, and others, do not seem to have met with any decided success—although for large lights of 250 candle-power and upwards they should prove serviceable, they are unsuited, economically speaking, for small lights, as so much current is necessary to heat even to redness the comparatively large carbon pencils employed in this class of lamp. Another disadvantage is, as we have shown in the arc system, the necessity of renewing the carbon pencil at frequent intervals, for although one electrode does not waste at all, the other consumes somewhat rapidly. Still there are advantages attached to this system that might prove most useful in many cases. Its simplicity of construction, and the ease with which a fresh pencil may be inserted, together with perfect steadiness of burning, constitute features of more than a mere superficial character. Of all these lamps, perhaps that of Joel is best known, it having been installed in several instances both in London and the country. Such a system may probably take an intermediate position between the arc lights and the incandescent, its value depending on the degree of temperature to which the carbon pencil is raised.

The purely incandescent light is being rapidly applied to a variety of purposes for which the arc light is unsuitable; amongst others may be mentioned mines, railway carriages, theatres, churches, ships at sea, offices, &c. It is said that the Holborn Viaduct is to be again lighted by means of the new agent, this time with Edison's incandescent lamp, which is also to be introduced into the City Temple by Dr. Parker. By far the most important and interesting installation of the incandescent electric light yet introduced, is that of the Swan system at the Savoy Theatre, in the Strand, where there are now 1,200 lamps arranged throughout the building. Although illumination by means of the electric arc will yet be required for innumerable purposes where a great light is needed, it appears almost certain that the monopoly of electric lighting will be held by the incandescent system, and we look forward to seeing our streets lighted by this method; that is, if the electric light is to take a permanent place in the future, such as gas holds in the present. Just now we do not, however, expect much headway to be made for really practical purposes by means of incandescent carbon filaments; and until they are manufactured to stand higher temperatures, the installations can scarcely be said to represent anything more than successful experiments. We have already expressed our belief that this improvement in the material will shortly take place, for, to insure perfect satisfaction in the working, it is necessary. As now made, any slight increase in the strength of the current beyond that normally employed, passing through the lamps invented by Swan, Lane-Fox, &c., is sufficient to destroy the filament. This is a difficulty that electricians must strive to overcome, both by improvements in the lamps themselves, and by better regulation of the current employed for the production of the light.

In conclusion, it may be of interest to mention that the use of secondary batteries for the regulation of the light-giving current, which has recently been brought forward as something entirely new, was proposed and made an accessory method by Mr. Edison in his patent for the iridio-platinum lamp, dated 1878. As a last remark we will give an extract from Mr. Moses Farmer's communication to Mr. Prescott, in which he describes his many and varied experiments on incandescent lighting:—"The method to which I have given most attention is that of rendering some of the metals with high melting points incandescent by the passage of a current of great density. This promises to be the most convenient for minutely subdividing and widely distributing electric light, especially for domestic illumination. An entirely new field for electric engineers is thus opened, in which our accumulated stock of knowledge will be most carefully employed." To the arc lamp, therefore, we must betake ourselves in special cases, we must make use of the Werdermann-Joel and such lamps for intermediate wants, and to the incandescence of metals and carbon we must look for domestic and general lighting of a moderate character; always bearing in mind that the higher the temperature of the material is raised, or, in other words, the greater the amount of light produced at one source, the greater the economy, for it is cheaper *per candle* to produce a light of 100 candle-power than one of 25 or 30.

LEGISLATION FOR CABLE PROPERTY.

IN our issue of December 15th in an article entitled "Legislation for Cable Property" we called attention to the desirability of having international laws for the protection of cables, and threw out at the same time suggestions by which the attainment of that object might be facilitated. As that article was in the press, we received a copy of a circular letter from Mr. Lewis Wells, the secretary of the Submarine Cables Trust, a copy of another letter being inclosed which it was intended should be sent to the Secretary of State for Foreign Affairs, after having received the signatures of all the telegraph companies willing to append them.

This letter alludes to the various causes of interruption to cables, and then proceeds to the subject of "obstruction by fishing boats, &c., to the operations of repairing expeditions." It afterwards mentions that the capital invested (in cable enterprises), "*now amounting to £25, 000,000, is unfavourably affected,*" and the whole system, "*operates to discourage those enterprising investors who have placed this country beyond question at the head of telegraphic enterprise.*"

Also it recommends a modification for cable ships of the usual quarantine regulations, and likewise "*some kind of exemption from ordinary custom house regulations, light and harbours dues.*"

All the objects it is desired to obtain by this communication to Earl Granville, are, no doubt, most worthy of the serious consideration of the Government of which he is a member, but we think more rapid progress would be made in their attainment, were the cable companies to afford assisting information to the Government as to the way in which some foreseen difficulties may be met, assisting information not only from the stand-point of cable investors but also from that of the fishermen. We are ourselves especially interested in the success of telegraphic enterprise, but we maintain that no legislation can be properly efficient which is not founded on the broad basis of equity and justice to all concerned. It is easily understood why the authors of the before-mentioned circular have not advocated the interests of those outside their own immediate circle; but we would suggest that by taking too narrow and selfish a view of the matter they may to some extent defeat their own ends, or at least prevent the fullest possible achievement of their objects. It is, however, quite probable that fuller information will be given by the deputation, which it is intended should follow the presentation of the letter.

In addition we would wish to draw attention to two somewhat contradictory statements in the circular. It contains a paragraph on page 2 to the following effect: "*That the ships employed are cable ships, and that they are employed upon cable work is known, because the ships carry distinctive signals both by day and night.*" On pages 3 and 4 occur the following passages: "*The Board of Trade require that steamships which are not under control must carry three red lights, one above the other, and cable ships while engaged in grappling consequently have to carry these lights.*

"*It is the practice of passing steamships, when they observe the 'not under control' signal, to assume that it is made by a disabled steamer signalling for assistance, and with the object of rendering aid they approach the cable-repairing steamer to their own danger from the buoys and from the cable which is being repaired, either of which might disable propellers and rudders by entanglement.*

"*A still more serious disaster might occur, should the commanders of steamships learn to assume that signals indicating a ship 'not under control' must belong to a cable-repairing ship, for a sinking steamer might have used all her rockets, and be reduced to the 'not under control' signal as the only means of attracting attention. Passing vessels might disregard the signal, believing it to proceed from a cable ship conducting her ordinary operations; consequently this identity of signals, for entirely different purposes, might be the actual cause of a sinking ship being unwittingly neglected and left to sink.*"

The first statement is to the effect that the cable ships have distinctive signals and must therefore be known, and the second says that the signals are not sufficiently distinctive and are liable to be mistaken. This is probably a slip, or required a little further explanation, difficult to convey in the limited space of a letter; we therefore do not desire to lay too much stress on the matter, but would rather observe that it is obviously necessary, in dealing with the subject of cable legislation, to provide that cable ships should, during laying and repairing operations, if not at all times, be easily distinguishable from any other ships whatever.

Since writing the above, the accompanying letter has been addressed to Mr. Pender, M.P., by direction of the President of the Board of Trade, on the subject of the memorial presented by the Telegraph Companies to Lord Granville, from which we extract the following portions:—

"Board of Trade (Harbour Department),
"Whitehall Gardens, S.W., Dec. 30.

"Sir,—I am directed by the Board of Trade to acknowledge the receipt of your letter of the 19th inst., addressed to the President, inclosing a printed copy of a letter which has been recently addressed to the Secretary of State for Foreign Affairs by the representatives of all the principal submarine telegraph companies on the subject of injuries caused to submarine telegraph cables by fishing and other vessels, and of the impediments placed in the way of repairing such cables through accidental or wilful removal or destruction of the gear used by the repairing ships, or otherwise; and you commend the matters treated therein to the serious consideration of this Department.

"The attention of the Board of Trade was called to this subject in October last, during the sittings of the recent International Fishery Conference at the Hague, by a letter from the Post Office to the Foreign Office, inclosing one from the Great Northern Telegraph Company, and one from the Submarine Telegraph Company.

"These letters were at once referred to the British delegates in Holland, where it appeared that the subject had already been raised in the conference by the representatives of the Danish and German Governments.

"The Conference, after considerable discussion, in which the importance of the question was fully admitted, decided that it was inexpedient to introduce any clause on the subject into the proposed convention concerning fishing vessels. In doing this they were actuated partly by the difficulties of the subject further mentioned below, but principally because the injuries and difficulties complained of by the telegraph companies related chiefly to vessels other than fishing vessels, and because to introduce a new and foreign subject into the convention would have endangered or delayed the attainment of its original object, which was to keep the peace among fishing vessels of different nations.

"The decision of the conference was communicated by the Board of Trade to the Foreign Office on the 1ts of November.

* * * * * *

"Finally, on December 12th, a memorial was presented to the Foreign Office by all the telegraph companies, embodying all their grievances, and a copy of this memorial was on the 21st of December received by the President from you asking for an interview."

Having given a list of the grievances complained of, the letter then proceeds—

"There is one observation which applies to all these causes of complaint, and which in itself affords a reason why neither the Board of Trade, nor any other Department of Her Majesty's Government, or even the British Legislature, can, even if so disposed, afford immediate relief. This is that in every one of the cases of complaint mentioned in the memorial foreign nations are concerned as well as ourselves, and we can only proceed with their concurrence. This is, of course, no reason why Her Majesty's Government should not take the initiave where they see their way clearly; but it makes it imperative on them so to do before they make communication to foreign Governments.

"Taking the several points in succession, the following appear to the Board of Trade to be considerations which must be borne in mind, and which show that the suggestions of the companies require more consideration than they have yet received.

"1. As to the injury done to cables by anchors and by trawls. Upon this it is to be observed that *primâ facie* the sea is free to all vessels, and that, before the general rights of navigation or free fishing are restricted, not only some good cause must be shown, but some feasible mode of restriction suggested. As regards anchoring, it is a question not only of convenience, but of safety, and considering the number of telegraph cables, the different courses and directions which they take, and the impossibility of marking them or denoting their locality to passing ships, it would be as unjust as it would be impracticable to deny to passing ships the right of anchorage, which they have always enjoyed.

"As regards trawls, it does not appear on examination that much, if any, damage is caused by them, unless they are improperly repaired, so as to leave projecting pieces of iron. Considering the impossibility of examining every trawl to see that it is in a proper condition before it is used, it does not appear practicable to legislate on this particular point. Nor does there seem to be any *primâ facie* reason why trawlers should be required to abandon their fishing grounds to cables, or why cables should not, so far as possible, be laid in parts of the sea not used by trawlers.

"Further, as regards both anchoring and trawling, it is not the interest either of ships in general or of fishing vessels to injure telegraph cables. On the contrary, they are themselves delayed and injured by the fouling of their anchors or their gear, so that it has been proposed in some of the papers before the Board that the telegraph companies shall pay compensation to the vessels which have been detained by fouling a cable innocently, when no damage is done to the cable.

"This same consideration makes it somewhat difficult to suggest any practicable penalty for cutting a cable which has been fouled. To cut a cable wilfully and needlessly, when with a little trouble the anchor or fouling gear might be disengaged without danger or loss, is no doubt an offence which ought to be, and probably is, punishable by damages. But if the question of the loss of an anchor is involved, and of possible danger or great inconvenience from this or other causes, courts of law would probably look leniently on the cutting of a cable, whether in a suit for damages or for a penalty. The probability of such a defence, and the difficulty of proving wilful damage, are serious obstacles to efficient legislation.

"2. As to interference with cable-laying operations.—Some of the objections which have been stated above apply to this cause of complaint also, but in a minor degree. The cable laying is temporary, the cable-laying vessels and their buoys can be distinguished, and, if they are in possession of the ground, there seems to be no reason why fishing vessels should be allowed to disturb or injure them pending their operations. There would, so far as destroying and unshackling buoys is concerned, remain the difficulties of evidence, difficulties which are much enhanced by the different nationalities of the different fishing vessels. But, subject to these difficulties, the Board of Trade see no reason why some attempt should not be made to meet the views of the telegraph companies on this point.

"It must not, however, on the other hand, be overlooked that there have been complaints by the masters of fishing-boats that their nets have sustained damage through cable-laying buoys being placed on the fishing grounds without any notice, and that claims for compensation on this account have been, without success, made on at least one of the companies.

"Wilful and unnecessary damage to telegraph-laying ships and their gear is an offence which certainly ought to be prevented wherever it is practicable.

"3. As to interference with cable laying by quarantine regulations—this is not a matter for the Board of Trade, but for the Foreign Office.

"4. As to Customs regulations and light and harbour dues—the Customs regulations here referred to appear to be those of foreign countries, and are therefore matters of which the Board of Trade have no cognisance. They would require to be dealt with in detail and through the Foreign Office.

"As to light and harbour dues, the Board of Trade can see no reason for exempting cable-laying vessels from dues which other vessels pay. The exemption of Government vessels from these dues is questionable in principle, as is shown by the recent action of the Government and Parliament in respect of local rating. And there is certainly no reason to extend this exemption to vessels belonging to private companies which exist for purposes of profit and which have the full advantage of the services for which the dues are levied.

"5. As regards the signals which cable-laying ships are required to use—these signals were recommended by a committee on which the Admiralty, the Board of Trade, and the Trinity House were represented, and they have been adopted by all maritime nations. It is to be observed, with respect to them, that they are not, and were not intended to be, signals of distress, which, as authorised by the Board of Trade, are signals of a very different character.

"That they have been construed to be and are looked upon by passing ships as signals of distress is a result which was not foreseen when they were devised, and when one of the great objects in view was to avoid an unnecessary multiplication of different signals. Experience, however, seems to have shown that they are open to the objection above referred to, and the increase in the number of cable ships has increased the inconvenience. Under these circumstances, the Board of Trade propose to refer this point to the above-mentioned committee, which is about to meet again.

"If, after consideration of these observations, and the preparation of definite answers and suggestions, the telegraph companies should desire a personal interview, the President will be happy to receive a deputation.—I am, &c.

"C. CECIL TREVOR.

"Mr. J. Pender, M.P., 66, Old Broad-street."

ELECTRIC LIGHT MEASUREMENTS.

By H. R. KEMPE.

I.

THE importance of accurate measurements in electric light trials cannot be over-estimated. From a scientific point of view, the subject is one of great interest, whilst commercially it is one of great moment. The extraordinary differences which are observed in results which should apparently have equal or nearly equal values, can only arise from carelessness in observation, or from the unsuitableness of the apparatus employed for the purpose of measurement. The latter is a very fruitful cause of error. Professors Ayrton and Perry have well said that* "beginners . . . . . fall into the habitual error of attempting to weigh a few grains of dust with a weigh-bridge suitable for weighing a railway truck." We are inclined to think that it is not beginners only that fall into this error, but that many of the discrepancies that are found in the figures given by authorities whose opinions are too often taken as being beyond question, are due to this cause.

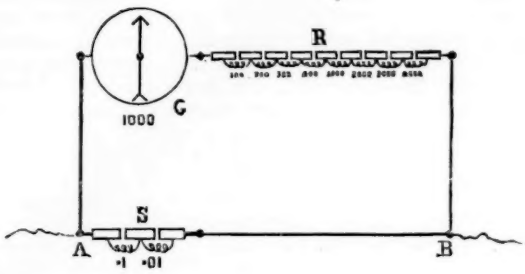
To obtain accurate results we require accurate observations, made on accurate instruments by accurate methods. The fact should never be lost sight of, that the accuracy of a result is limited by the accuracy of every observation required to obtain that result, and that no matter how truthfully a number of connected observations may be observed, yet if one of those observations be inaccurate, the degree of accuracy of the result will be at least correspondingly untrustworthy. We say "at least," because *every* measurement introduces a *possible* error; thus, if we require three different kinds of measurements to obtain a particular result, and if there is the possibility of a 1 per cent. error in each, then we cannot be certain of the result to a greater degree of accuracy than 3 per cent., the total possible error, in fact, is the sum of all the errors. The subject of error of observation is really deserving of more attention than is usually paid to it; and in considering the various measurements which are of practical utility in dealing with the electric light, care will be taken to point out possible sources of error and the way to avoid them, and also the possible degree of accuracy which can be obtained with any particular method.

MEASUREMENT OF CURRENT STRENGTH.

Perhaps the simplest method of measuring current strength is by means of a tangent galvanometer, the measurement being made by comparing the deflection given by the current whose strength is required with the deflection given by a current of known strength. The unit of current, the ampère (formerly the weber), is the current given by an electromotive force of one volt flowing through a resistance of one ohm. Now, the current given by a Daniell cell in good condition, and with the zinc immersed in a semi-saturated solution of sulphate of zinc, is 1·079 volts; hence a current of one ampère is obtained by such a Daniell cell in a circuit of 1·079 ohms resistance. Practically it is almost impossible to obtain so large a standard as one ampère, as the resistance of the battery required to give such a current would have to be extremely small, so as practically not to enter into the total of 1·079 ohms, and such a battery would be of inconveniently large dimensions. It might be argued that the resistance could be allowed for, but practically this could not be the case, as no resistance is, perhaps, so variable and unstable as that of a battery, and accuracy would be greatly jeopardised by attempting to make such an allowance. By using a submultiple of the unit, such for instance as the milliampère ($\frac{1}{1000}$th ampère), we can avoid the difficulty referred to, for the resistance of the circuit can be made almost all external. If the resistance of the circuit were chiefly that of the battery, then a mistake of, say, 10 per cent. in the resistance of the latter would roughly mean a mistake of 10 per cent. in the total resistance, and a consequent similar mistake in estimating the value of the standard current, but if the external resistance were 100 times as great as that of the battery then the 10 per cent. error in the battery resistance would approximately mean but an error of $\frac{1}{10}$th per cent. in the total resistance. If then we take a Daniell cell having an internal resistance of, say, about 10 ohms, and we insert it in a circuit of 1,069 ohms, we shall have very approximately a current of $\frac{1}{1000}$th ampère flowing. Having obtained such a standard, how are we to make use of it so as to enable currents of great strength, say, 100 ampères, to be measured with accuracy? we have in fact to measure a current by means of a standard which has but $\frac{1}{100000}$th of its dimensions. The difficulty of doing this is by no means great, nor need accuracy be sacrificed. A tangent galvanometer is easily constructed which will give about 45° deflection with one milliampère of current. The pattern used by the General Post-office, which is wound to a resistance of about 320 ohms gives about 30° deflection with one milliampère of current, and this deflection can be increased by means of an adjusting magnet, though for rough work such an increase in sensitiveness is not desirable, as the needle is thereby more liable to be affected by external influences. Such a galvanometer wound to a resistance of, say, 1,000 ohms, would give 45° with one milliampère of current and with the needle adjusted comparatively coarsely by means of the adjusting magnet. With such a galvano-

* *Telegraphic Journal*, Oct. 1st, 1881, page 383.

meter, a small set of resistance coils adjustable by units up to a total of 100 ohms, and a one cell Daniell battery, one milliampère of current can easily be obtained. We have simply to ascertain approximately the resistance of the one cell and then to join up the latter in circuit with the galvano-



meter and the resistance coils, and adjust the latter till there is a total of 1079 ohms (galvanometer coil + battery + resistance coils) in the circuit, then the deflection obtained will be that due to one milliampère of current.

Now, if we shunt the galvanometer by a resistance of $\frac{1}{100}$th* of an ohm then this shunt will reduce the sensitiveness of the instrument to $\frac{1}{10000}$th, consequently a current of 100,000 milliampères, that is 100 ampères, would give a deflection of 45° on the galvanometer. Instead of employing a $\frac{1}{100}$th ohm shunt, a shunt having a resistance of $\frac{1}{10}$th of an ohm* could be employed provided there were inserted in the galvanometer circuit a resistance of 9,000 ohms, so that there is a total of 10,000 (9,000 + galvanometer coil) in the circuit. This arrangement has numerous advantages. In the first place it is much easier to adjust accurately $\frac{1}{10}$th of an ohm than $\frac{1}{100}$th, and, moreover, by making the 9,000 ohms, 8 independent coils of the respective values :— 100, 200, 300, 400, 1,000, 2,000, 3,000, 4,000 ohms, the whole apparatus can be arranged so as to measure any current from 10 up to 100 ampères with considerable accuracy. The author has pointed out† that to obtain accurate results with the tangent galvanometer it is advisable to obtain the readings as near to 45° as possible. Now to do this for currents of various strengths all that is necessary is to adjust the resistance in the galvanometer circuit till the required deflection is approximately obtained ; thus if the current to be measured were about 35 ampères, then a resistance in the resistance coils of 2,500 ohms (equal to a total of 3,500 in the galvanometer circuit) would bring the deflection to about 45°, the *total* resistance in the galvanometer circuit should in fact be directly proportional to the current to be measured. By adding a second shunt coil of a resistance of 1 ohm, currents as low as one ampère could be measured, and on the other hand by means of a shunt of $\frac{1}{100}$th of an ohm a current of 1,000 ampères could theoretically be measured. The general arrangement of the apparatus described, when connected up for measuring the current, is shown by fig. 1.

Before proceeding to consider the exact operations to be gone through in using such an apparatus as that described, attention might be drawn to an important fact in connection with electrical measurements, which is continually overlooked, it is that if accuracy is required, every apparatus must be adjusted and arranged for the particular measurements that are to be made. Numerous galvanometers have been devised which profess to give the strength of a current by a direct reading, and without the use of resistance coils for shunts, &c. ; such galvanometers can only give accurate results within a very limited range of their scale and are almost useless for making measurements beyond that range, thus a galvanometer which indicates accurately a current of 25 ampères will be not nearly so accurate if the deflection indicates 50 ampères on the one hand or 10 ampères on the other ; for general purposes simplicity is certain to be obtained at the cost of accuracy, and practical men who so often say that an apparatus for testing is of no use unless it is simple may find that this simplicity will cause far greater errors to be made and untrustworthy results to be obtained than would be the case if apparatus a little more complicated, and properly designed, were employed, and which after all does not require any very extraordinary amount of intelligence or skill to manipulate.

(To be continued.)

* $\frac{1000}{99999}$ more correctly, but the error due to taking it as $\frac{1000}{100000}$ or $\frac{1}{100}$ would be absolutely inappreciable. A similar remark applies in cases where a $\frac{1}{10}$th ohm, or a 1 ohm, shunt is used.

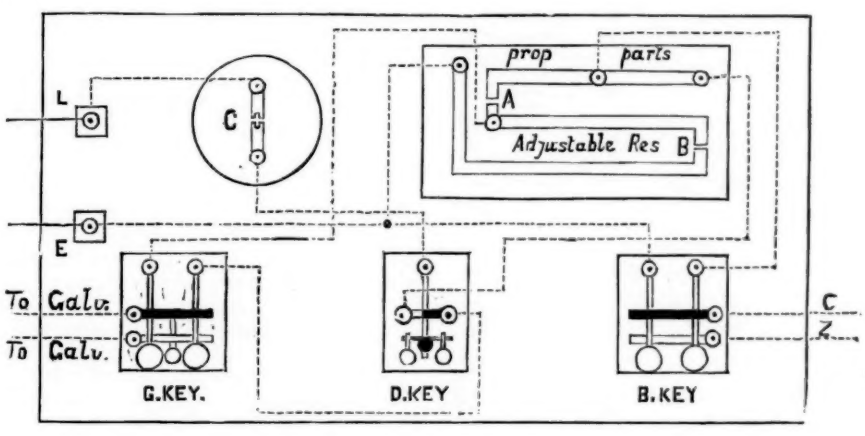
† See *Telegraphic Journal* July 1st, 1877, and "Handbook of Electrical Testing," second edition, page 19.

THE PARIS ELECTRICAL EXHIBITION.

THE BRITISH SECTION.

SABINE'S TEST BOARD.

THIS test board, a plan of which is shown in the accompanying sketch, was devised some years ago by Mr. Robert Sabine, and exhibited by him in the recent Electrical Exhibition of Paris. It is very complete and compact, and although containing nothing which could not have been arranged by others, it is, we believe, the only board of its kind at present existing. In construction it consists of a mahogany slab, on which are fixed a Wheatstone's bridge, a battery reversing-key, discharge-key, galvanometer re-



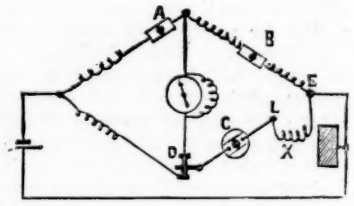
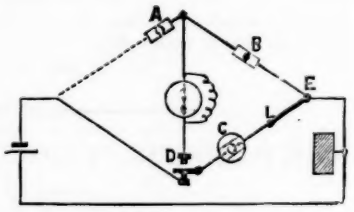
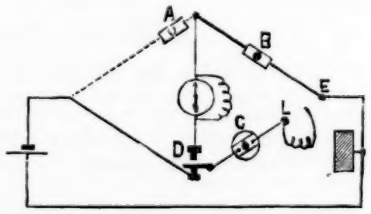
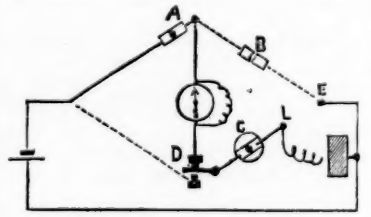
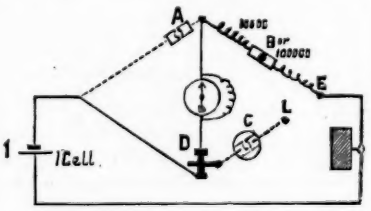
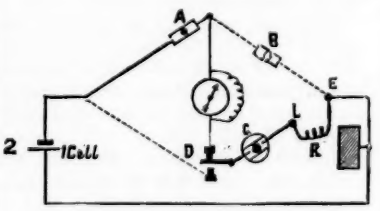
versing-key, a standard condenser, and two insulated terminals representing line and earth.

The "Wheatstone's Bridge" is arranged very much as ordinarily made, the one side of the proportional parts can be divided from the adjustable resistance at the plug A, and the adjustable resistance can be broken at the plug B. The resistance, however, is arranged with the addition of a 20,000, 30,000, and 40,000 ohms coil, so that a total resistance in a direct circuit of 100,000 ohms can be unplugged. This will be used especially when taking the constant of the galvanometer. The battery reversing-key is of the common form. The discharge-key, which is of Mr. Sabine's well-known pattern, has one addition over those

generally seen. The top contact is movable and cam-shaped, so that by turning a small handle (of which it forms part), from the vertical to the horizontal position, the top and bottom contacts may both be brought into connection with the lever of the key which is thus completely short-circuited. The remaining reversing-key has the short circuiting-key

SABINE'S TEST BOARD.

TABLE OF DIAGRAMS.

TEST.	POSITION.	PLUG A	PLUG B	PLUG C	LEVER D of DIS. KEY.	BETWEEN L & E.
Bridge (Copper Res.)		In.	In.	In.	On both top and bottom contacts. Key forming part of bridge circuit.	Resistance to be measured.
Discharge of Accumulator.		∞	In.	∞	On bottom contact.	Short circuit.
Discharge of Cable, &c.		∞	In.	In.	On bottom contact.	Cable to L.
Insulation Test by Loss of Charge.		∞	In.	In.	1. On bottom contact for charging. Insulate. 2. On top contact for discharge.	
Insulation by Deflection.		In.	∞	In.	On top contact.	Cable to L.
Constant of Galvanometer.		∞	In. (Res. = 10,000 or 100,000	In.	Key closed and forming part of circuit.	∞
		In.	∞	In.	On top contact.	Resistance of One Megohm.

NOTE.—Since writing the above we are informed that Mr. Sabine has supplied several of these test boards to the Russian Administration.

of the galvanometer attached to it, which is a great convenience, this little instrument having previously been always used separately. The connections are all made above the board of thick copper wire, and painted different colours to represent the respective circuits.

Those accustomed to tests of any kind, and more especially to testing submarine cables, will know how much time is wasted, how much confusion may sometimes occur, and how many apparent errors creep in when it is necessary (as it generally is with present arrangements) to change wires for the various tests of copper resistance, discharge of condenser and cables, insulation readings, constant of galvanometer, &c. It was to avoid all such sources of error that Mr. Sabine devised the test board here described. The chief novelties in the whole arrangement may be thus enumerated: all the connections are permanent, visible, and in air; there is no change of wires for any test, and no commutators; the combination of reversing and short circuiting-keys for the galvanometer, and the peculiar form of upper contact for the discharge-key, whereby the whole key may be made part of the circuit; and last, but not least, the ease with which all parts of the apparatus may be manipulated and the time spared in the various operations.

The galvanometer and shunt may, of course, be placed in any convenient position. A commutator for putting on different batteries for copper resistance, inductive capacity, and insulation tests, might be attached to the board, but Mr. Sabine prefers to use each battery quite distinct from the rest, disconnecting one when finished with, and connecting another when required. We give a table with diagrams showing the position of each part of the apparatus for the various tests required; it does not need description, as the figures speak for themselves.

In some instances, where a megohm can be obtained, it simplifies matters to take the constant of the galvanometer with the whole of the testing battery through the megohm, thereby avoiding the otherwise necessary tests of comparing the battery ratios. The arrangement for this is shown in the last diagram, where the testing battery may be substituted for the one cell.

SOCIETY OF TELEGRAPH ENGINEERS' LIBRARY.

IT must have been satisfactory to the members of the Society of Telegraph Engineers and of Electricians to find, from the report of the Librarian, Mr. A. J. Frost, which was read at the annual meeting, that the library is in such an efficient condition. It will be remembered that this library was opened to the members of the society and to the public on the 1st of January, 1881, and it has been open on every evening (except Thursdays and Saturdays) till eight o'clock, in order that those who are engaged in the daytime may have a convenient opportunity of consulting the library. We learn from the report that, although the library since its opening has had barely sufficient time to be well known, there have been about 350 visitors during the year. These numbers are not very great; but then it must be remembered that the library is devoted to a special subject, and special libraries are not well attended. This attendance, small as it may appear, shows that such a library for reference was required, and its usefulness has been made apparent.

The accessions to the library during the year, referred to in the Report, have been very numerous, and form a well compiled catalogue of over 160 books and papers, more than two-thirds of them having been obtained by presentation from their authors and others. Special reference was made to an important presentation from the Bureau International des Administrations Télégraphiques (Berne), and as the library is the only one in this country devoted to electricity, &c., we think that an effort should be made by the Council to obtain copies of all state documents from the Telegraph Administration of Europe, in order that the library may be made as complete as possible.

The collection of Electrical Specifications of Patents which the Society possesses is one of the most important parts of the library, and as they are obtained immediately after publication, visitors to the library are enabled to consult all the latest specifications without a previous search and a visit to the Patent Office for the purpose. We may add that there were about 450 electrical patents taken out during the past year.

It is satisfactory to learn that although there were several important foreign collections of electric books exhibited at the Paris Exhibition, none of them contained many of the rare books on the subject which the Society itself could not have exhibited.

The importance of the Ronalds Catalogue has already been recognised in a practical manner by the fact that two important bibliographies have been partly compiled by its aid—one, the Italian bibliography of electricity and magnetism, published by the Italian Government, and the other a catalogue of books and papers relating to lightning and lightning-conductors, compiled by J. G. Symons, F.R.S., which will form part of the Report of the Lightning-Rod Conference, which will shortly be published.

It is unnecessary to refer to the practical value of well-compiled indexes, and we are glad to learn that the much desired Index to the Society's Journal from the commencement has at last been made by Mr. Frost, and has been offered by him to the Society for its acceptance. We venture to think there can be no doubt that this index compiled to the end of the tenth volume will be accepted. The Society's Journal contains a large mass of information upon all subjects connected with electricity and telegraphic engineering, but from the want of such an index as that compiled by Mr. Frost it has been to a great extent lost sight of. We think that this index cannot fail to render the Journal of the Society of much greater value than hitherto.

NOTES.

THE PARIS ELECTRICAL EXHIBITION.—We are glad to announce that the French Government has shown its appreciation of the services of Mr. John Aylmer, of Paris, by conferring upon him the distinction of Chevalier of the Legion of Honour. We need not repeat what all our readers already know, how Mr. Aylmer, as secretary to the British Commission, worked to insure success. His exertions materially contributed not only in originating the participation of England in the Exhibition, but more particularly to the successful way in which our section was carried on in spite of many adverse and unforeseen circumstances. Those who, like ourselves, had any business transactions with the British Commission fully appreciate Mr. Aylmer's courtesy and forethought, and we feel sure that all will be glad to hear of his well-merited distinction for services which might well be called international, so severely must his linguistic abilities have been taxed. This decoration from the French Government, however, is only honorary, and if the English exhibitors only show as much appreciation of all that Mr. Aylmer did for them we think it would be a graceful tribute to him to get up a substantial testimonial amongst themselves with which to present him.

The following decorations of the Legion of Honour have also been awarded to our English representatives in Paris :—

Sir William Thomson ...	Grand Officier.
Earl Crawford	,, ,,
Professor Hughes	,, ,,
Dr. C. W. Siemens	,, ,,
Dr. Warren de la Rue ...	,, ,,
Sir Charles Bright	Officier.
Col. Webber	,,
Mr. E. Graves	,,
Mr. Preece	Chevalier.
Professor Forbes	,,

THE DANGERS OF ELECTRIC LIGHTING.—The recent accident at Hatfield House, whereby a labourer lost his life through coming in contact with the naked wires conveying the electric current from a Brush machine, will be apt to make most people engaged in the installation of the electric light fully alive to the risk they run in dealing with such high tension currents. We are already aware of at least three fatal accidents which have occurred through the use of the alternating Gramme, and it is a rather serious matter that four fatalities should have happened in so short a period. When the gas explosion took place some time since in Tottenham-court-road, unfortunately attended with fatal results, those interested in electric lighting took the opportunity of setting forth the immunity from accidents, entailing death, which would result by the abolition of gas and the use of the electric light. We can now count more deaths resulting from contact with wires conveying the electric current than took place in the terrible explosion of gas which convulsed a great portion of London. In a letter to the daily papers, the manager of the Brush Company repudiates the idea that they were in any way responsible for the sad occurrence, as the installation was not effected by the Company, who invariably use insulated wires. We think that, in one instance, at any rate, he is in error; for, if we mistake not, the wires of the Brush system at Liverpool-street Station are all unprotected and stretched between ordinary porcelain insulators. We are not informed what number of lights the particular machine which was being tried at Hatfield House feeds, but we presume it was one giving 1,600 volts or more. Even supposing the wires themselves are insulated sufficiently, there is always the same risk run in touching certain parts of the lamp. Of course, every precaution is taken by the employés of the Electric Light Companies to avoid accidents; but with those quite unacquainted with the extraordinary tension of such currents, the case is different; and it will soon become questionable whether it will not be advisable to keep down the electromotive force of such machines to certain limits, just as the pressure of steam is regulated in a boiler.

NEW ELECTRIC LIGHT COMPANY.—The Baltic Works, Bridgeton, Glasgow, says the *Glasgow News*, have been purchased by a company for manufacturing electric light and electromotive power apparatus. The company will be principally occupied with the manufacture of the "Akester and Kennedy" patent dynamo machines and accumulators. The Company intend at once to construct a 600 horse-power dynamo machine to light 3,000 incandescent lamps of 25 candle-power each.

THEATRES AND THE ELECTRIC LIGHT.—We did not wish to draw the attention of our readers to the horrible catastrophe which has taken place at Vienna, but the number of victims so far surpasses all expectations that it is impossible not to dwell upon the duties which this tragedy imposes upon municipal administration. We believe that the last nights of gas have arrived for all halls intended for scenic representations. We can also announce that the Grand Commission of the applications of electricity named by M. Herold will not fail in its duties, and that its decisions will be formal. The exclusion of gas will be radical and absolute. But in order that the decision of the council may be carried out satisfactorily, it will be necessary for the advantages and defects of the various systems of lighting to be scientifically determined. It is incumbent, especially on those interested in incandescent lighting, to give details as to the prices they will demand for their installations. It is certainly not to their interest to continue to surround themselves with a mystery which has perhaps already lasted only too long.—*L'Electricité*, Dec. 17th, 1881.

THE SAVOY THEATRE.—At an afternoon performance of Sullivan and Gilbert's "Patience" on Wednesday, Dec. 28th, the stage and its accessories were lighted publicly for the first time by Swan's incandescent electric light. The body of the theatre has for some time, in fact since its opening, been illuminated by this system of which we gave some particulars in our issue of October 15th, with most satisfactory results as far as appearances go. On the afternoon in question and during the interval Mr. D'Oyly Carte, the lessee of the new building, made a few remarks to the large audience assembled, explaining to those not acquainted with the electric light the principle of Swan's invention. The speaker dwelt on the immunity from fire or explosion which must result from the use of such a mode of lighting, and showed experimentally that any fracturing of one of the vacuum globes inclosing the carbon filament would result in the extinction of the light.

We are informed that as many as 1,200 lamps are now working in this theatre arranged in the following manner:—For lighting the body of the theatre, 250 lamps; for the stage and its accessories, 870 lamps; buffets, lavatories, offices, entrance, &c., 80 lamps.

These figures, we believe, are approximately correct. The machines for producing the current necessary for these lamps consist of 6 Siemens alternating current machines of the W' type. These have each an exciter of the D' type, making in all 6 sets of two machines each. Each alternating current machine feeds 200 lamps. There are two engines by Fowler of 16 horse-power nominal each, and these are apparently severely taxed, so much so in fact that it is said more powerful engines will be employed. The horse-power effective to drive these 1,200 lamps is very great. We do not know the exact indications, but it must be between 120 and 150 horse-power. The lamps at their best do not give more than 15 candle-power each, and 10 lamps are reckoned to be worked with the expenditure of one horse-power. The power of the light may be regulated at will for stage effects by the introduction of resistances into the circuit. At the maximum, therefore, the total light at the most effective time is only 18,000 candles, with a minimum employment of 120 horse-power. Arc lights would probably produce the like result with one-eighth the horse-power now expended; but as arc lamps are scarcely admissible into a theatre for such purposes, it will not be necessary to enter into the matter of comparative economy. But, seriously speaking, the exhibition at the Savoy Theatre is most disappointing. Having seen them on two occasions, we can justly say that at any time the candle-power on the average of each lamp, taking them all round, is not equal to ten candles. We noticed on the stage a considerable number extinguished, in some rows as many as ten per cent., others merely glowed like a *red* hot piece of

charcoal, showing that either by faulty contacts or variations of resistance they were not receiving their proper amount of current, whilst others got an excess. As many gas jets would, in our opinion, light the stage much better. Still, the advantage to audience and performers is very great as regards the moderated temperature of the theatre, the absence of noxious fumes, and the reduced risks of fire, the latter danger having of late shown the necessity of some better mode than the use of gas for lighting places of public entertainment. The conjecture of the *Daily News* that the cost must be more than double that of gas, and amounts to £2,000 per annum, is probably near the mark, under the figure if anything. It would be interesting to know how many of these incandescent lamps are destroyed during each performance; for as they do not appear to be particularly well chosen as regards the resistance and mass of the filament being the same in each instance, it is obvious from our own observation that a certain percentage must be lost. However, the installation at the Savoy Theatre is a step in the right direction, and the results obtained will be of great advantage to electric light engineers in the future, although at present it seems to us that an enormous amount of power is used for a very small result, this being particularly noticeable on the stage, where we think 20 or 30 of the semi-incandescent lamps of Werdermann or Joel would have produced a better effect, could have been regulated just as easily for stage devices, give the same coloured light, are quite steady, and would not consume nearly as much power to give the necessary illumination.

Although advocating the use of the electric light in such public buildings, we do not think that other theatrical managers would do wisely in following Mr. D'Oyly Carte's example in setting up an installation of 1,200 Swan lights in their present state of efficiency, and we therefore suggest that exhaustive trials should be made of all systems, especially those of incandescence, before any are finally adopted for such purposes. The details of electric lighting, such as the light produced for power expended when one, two, four, or many lamps are in a circuit, the cost of machines, lamps, and of working the system for small and large erections, the guaranteed length of time that a lamp can last, the candle-power it may be worked up to with safety, and many other points, are shrouded in mystery, inventors seeming to shun giving publicity to these matters, when they should be aware that by frankly giving the fullest details in connection with everything relating to their apparatus they would in reality be ventilating and establishing true data to work upon, and make perfection approach much nearer than at present, and that in a very short time. There are so many points in electric lighting upon which electricians are divided, that the sooner publicity is given to experimental results upon the various competing systems, the sooner we shall have established laws (which shall be common to all workers) as we now have in telegraphy in all its branches.

THE ROYAL ACADEMY EXHIBITION.—The Swan lamps and Siemens machines are used at this exhibition, where a good display of Old Masters is now being shown. We were present on Monday evening last, but as the installation had only recently been completed, and was perhaps in consequence not very satisfactory, we defer full notice until another issue.

DYNAMO MACHINES, REACTION PRINCIPLE.—We generally attribute to Wheatstone and Siemens the idea of exciting the inductors of dynamo-electric machines by the current itself by placing them in the same circuit. The idea was presented to the Royal Society of London by the two inventors on the same day, February 14th, 1867. We have seen here even that M. Pacinotti had thought of the same idea several years before, and had published it nearly three years before, in June, 1864, in *Il Nuovo Cimento*. *Engineering*, of London, has just published a very curious letter, in which it is shown that this idea is even before Pacinotti, and that it dates back as far as the year 1854. In fact, in an English patent taken out by a Dane, Soren Hjorth, of Copenhagen, October 14th, 1854, is found the following passage :—"The principal arrangement of this machine (Battery) consists in the disposal of one, two, or several permanent magnets of cast-iron, in combination as is seen with an equal or greater number of electro-magnets, *in such a manner that the currents induced in the coils of the revolving armatures pass round the electro-magnets; consequently, the more the electro-magnets are excited in the manner above-mentioned, the more the armatures are excited, and the more electricity is naturally induced into the respective coils.*" In a second patent, dated April 11th, 1855, we find this characteristic passage, relative to another generator of electricity :—"*The permanent magnets acting on the armatures brought successively between the poles induce a current into the coils of the armatures, which current, after having been made by the commutators to travel in one direction, passes round the electro-magnets, charging them and acting on the armatures. By this mutual action between the electro-magnets and the armatures an accelerating force is obtained, the result of which is to produce electricity in a greater quantity than has been attained until now by any other similar method.*"

From this document it appears clear to us that Soren Hjorth had really the first idea of the principle of re-action —of the dynamo, as it is sometimes called — a principle afterwards re-invented successively and independently by Pacinotti, Siemens, Wheatstone, and Varley. There is nothing new under the Sun.—*L'Electricien*, December 15th, 1881.

Dr. Paget Higgs writes on this subject to the *Scientific American*, for the 10th inst., as follows :—

In the issue of your supplement, dated November 19th, appears a special article by Dr. Gustave Glaser. This article contains some historical remarks that I am sure you, with the usual American desire to give every man a fair hearing, will allow me to object to. Dr. Glaser offers therein what he is pleased to think unimpeachable evidence of the prior right of Dr. Werner Siemens to the discovery of the principle of "mutual accumulation" in dynamo-electric machines. But Dr. Glaser is too evidently biased. He does not accord to Sir Charles Wheatstone that proportion of a great discovery which he accords to Dr. Werner Siemens, unwittingly thereby paying Sir Charles the greater compliment since he acknowleges a difference only of a month in publication. Now, sir, I have had the honour of having been chief assistant to Sir Charles Wheatstone for a considerable period, and the greater honour by hard work to have been placed in close familiarity with so eminent a man of science, who was pleased to show me, many years before this claim of German priority became so pressing, the notes of his experiments on this principle of "mutual accumulation," made several years before publication. Before his death, however, Sir Charles told me that he believed that priority was really due to Hjorth, the Swedish electrician. As Sir Charles Wheatstone has been dead some years, I have, of course no personal interest other than that due to the memory of an old master in claiming for him the priority due to him, except it be a new version of the trite saying, "Dead men can tell no tales" (for themselves). Dr. Glaser says :—"By a comparison of both lectures it is plain to see

that Mr. Wheatstone mentions nothing that had not been said six weeks before publicly by Dr. Werner Siemens in Germany." There is, sir, a great deal, which even the Dr. C. William Siemens, of London, is good enough to acknowledge in his paper read before the Royal Society recently, on March 4th, 1880.

GREAT COMBINATION.—We are informed that the formation of a new company is nearly completed for the purpose of taking over several already existing electric lighting companies, amongst others the Compagnie Générale d'Eclairage Electrique, which itself possesses, as was stated in our issue of November 15th, the French patents for the Jamin, Jablochkoff, Jaspar, Werdermann, and Maxim lights, and also the Gramme patents. A leading feature in the programme of the new company is the introduction of a system of distributing motive power. The capital is £4,000,000 sterling.

VARIATIONS OF THE RESISTANCE OF ELECTRIC MACHINES WITH THEIR SPEED.—By M. E. Lacoine.—It is known that the resistance of magnetic and dynamo-electric machines is not constant, but increases with their speed. Certain experiments seem to show that these variations of resistance may be explained by the variations of contact between the movable commutator and the friction springs. The author made use of a copper cylinder of 0·05 metre in diameter, with longitudinal grooves, which resemble the isolants of a Gramme commutator. Against this cylinder rub, at two points diametrically opposite, two steel springs, in which terminate the two ends of a circuit, comprising a battery, a telephone, and a galvanometer to measure the resistances. When at rest the resistance = 68 ohms; at the speed of 2,000 revolutions it was 183, and rose with increasing speed to 2,900 ohms. The sound given by the telephone was stronger and higher as the speed increased. At each speed the resistance diminished on augmenting the pressure of the springs. For one and the same pressure the resistance seemed proportional to the cube of the speed. A more intense sound is heard with the telephone when the intensity of the current is less. Hence the author concludes that the sound given by a telephone introduced into the circuit of a Gramme machine is due not merely to the undulatory variations of the current, but also to the microphonic effect of the commutator.—*Comptes Rendus.*

THE UNITED TELEPHONE COMPANY (LIMITED) *v.* ALEXANDER MACLEAN, EDINBUGH.—We hear that the United Company are desirous of getting a verdict in the above case respecting the Edison patent. As we mentioned in our issue of December the 1st, an *interim* interdict was granted so far as concerned the Bell patent (Mr. MacLean has, we learn, since withdrawn his admission of infringement, as he hoped to show the patent null and void on account of prior publication), and the question of the infringement of the Edison patent has yet to be tried. The names of Mr. Conrad Cooke of London, Professor Blyth of Glasgow, and Dr. Fergusson of Edinburgh, are mentioned as witnesses for the respondent. It seems to us that even should the Company succeed in getting a verdict in its favour, it would not be regarded as a precedent, seeing that the matter is tried in a Scotch court, and also seeing that the respondent is a comparatively unknown electrician. With the legal means at the command of the United Company, it is a matter for comment that (if the Company believe in the validity of the patents held by it), it does not push to an issue some of the several cases it has threatened for a long time past in England, and thus settle once for all the (to them) vital question of monopoly, or free trade in telephones. The general position of these disputes appears to be this: There are but few in England who doubt to whom the honour of the invention of the telephone, or of one form of the carbon transmitter belongs; but we have heard much doubt expressed amongst electricians as to the validity of the Bell patent, and as to whether *microphone* transmitters are covered by the carbon transmitter patent of Edison.

PRIZE FOR DESIGNS.—We desire to call the attention of our readers to an advertisement in our columns offering a prize for "Designs for an Electrical Laboratory." This is an opportunity which we imagine many of our younger electricians will take advantage of, there being nearly two months' time in which to work out the necessary details.

TELEPHONE EXCHANGE WIRES IN SHEFFIELD.—Mr. John Walsh, late Divisional Engineer of the Postal Telegraphs, having been requested by the Sheffield Corporation to report on the security of the Telephone Exchange, and other wires in the borough, says:—"The Telephone Exchange wires of Messrs. Tasker, Sons and Co., are well and substantially erected by an efficient telegraph engineer; that the wires are placed on strong poles instead of being attached to buildings; and that there can be no better test of the strength of the work than the way in which the wires withstood the severe storms of October and November last without injury.

CABLE NOTES.—The steamship *International*, with the Goatzacoalcos-Vera Cruz section for the Central and South America Telegraph Company, arrived at Vera Cruz on the 17th December, ult.*

The steamship *Dacia*, loaded with cable for the same company, arrived at Rio Janeiro, on her way to the West Coast of South America, on the 19th December, ult.

The India-rubber, Gutta-percha, and Telegraph Works Company have been very fortunate in their repairs of the Lizard-Bilbao cable, belonging to the Direct Spanish Telegraph Company. The steamship, *H. C. Œrsted*, Mr. H. Benest in charge, left Greenhithe at daybreak on Sunday, the 11th ult.

On Wednesday, the 14th ult., the Lizard end was hooked 30 fathoms from break, and ship spoke to Lizard at 5.8 p.m. As the sheathing was found damaged, some $3\frac{3}{4}$ miles were picked up towards the Lizard, when, on cable being found to be in perfect condition, it was cut, and the Lizard end buoyed at 8.40 p.m.

The next day, December 15th, the Bilbao end was hooked and ship communicated with Bilbao at 9.50 a.m. New cable, of a heavier type than the one picked up was then spliced on, and paid out towards buoy on Lizard end. By 4.30 p.m. that same day communication between England and Spain through the cable was again restored, and considering that the *Œrsted* had to steam some 700 miles before beginning her work, and the total time occupied in the repairs being only $4\frac{1}{2}$ days, this is very smart work indeed, and great credit is due to Mr. Benest and those engaged in the operation.

* The steamship *International* (Mr. Theophilus Smith, engineer-in-charge), on the 3rd inst. successfully completed the Goatzacoalcos-Vera Cruz section above mentioned. This forms the first section of the system to connect Vera Cruz with Lima, and the West Coast of America Telegraph Company's cables.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.—There now seems some prospect of this Exhibition being, at least partially opened before long. It is announced that the Electric Light Apparatus will be ready by the 10th inst. The Electric Light and Power Generator Company, the Maxim and Weston, Mr. Strode, M. Graveur, of Paris; Messrs. Rowatt and Fyfe, and Crompton, are well advanced. The Brush Lights, under the direction of Mr. Hammond, are beginning to make a show; as also are Messrs. Siemens, M. Lontin, and the Société Générale d'Electricité. The British Electric Light Company will have twenty-six of their Brockie lamps at Sydenham, besides numerous incandescent lights. Edison is working actively, and making good speed. The Secretary of State for War has signified to the authorities of the Crystal Palace his intention to allow a collection of military electrical appliances now adopted in the service, to form part of the forthcoming Electric Exhibition at the Crystal Palace. It may be recollected that such a display was conspicuous by its absence at the Paris Exhibition, and it led the foreigner to draw a somewhat unfavourable conclusion as to the position which this country occupies with reference to this branch of electrical and mechanical science. Professor Abel stated at a recent meeting of the Society of Telegraphic Engineers, that in Military Electrical Appliances, England was in reality far ahead of any other nation.

BRADFORD IRON WORKS, MANCHESTER.—Messrs. R. Johnson and Nephew inform us that since the death of Mr. Richard Johnson, on the 16th of February last, the business has been carried on by the remaining partner, Mr. Johu Thewlis Johnson. He has now taken into partnership his brother, Mr. James Clarkson Johnson, the style of firm being continued as heretofore.

CORRESPONDENCE.

LIGHTNING CONDUCTORS.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—I am much obliged to you for the reply to my question about lightning conductors.

I have just read a very able paper on "Lightning and Lightning Conductors," by Mr. W. H. Preece, in the *Journal of the Society of Telegraph Engineers*, Vol. I., p. 336. He recommends, page 345, so small a conductor as No. 4 galvanised iron wire, and his remarks on the area protected by a conductor lead me still to doubt whether sufficient protection would not be given to my house by rods three feet above two of the *centre* chimneys.

Mr. Preece's views were so generally endorsed during a long discussion that I venture to bring them under your notice, seeking more information which, I believe, would be as welcome to many of your readers as to

Yours faithfully

17*th Dec.*, 1881. B.

[If our correspondent will refer to page 346 in the number of the Society's journal referred to he will see that Mr. Preece, to a certain extent, qualifies his first statements by saying, "No. 4 wire is amply sufficient for the protection of such buildings *as do not very greatly exceed our poles in height*." (The italics are our own). But apart from this statement, if "B." will refer to the number of the *Philosophical Magazine* for December, 1880, he will find an article by Mr. Preece, which shows that some of the latter gentleman's opinions have been modified (as the result of further experience, no doubt). In this article Mr. Preece arrives at the following law with reference to the area which a lightning rod will protect. "*A lightning-rod protects a conic space whose height is the length of the rod, whose base is a circle having its radius equal to the height of the rod, and whose side is the quadrant of a circle whose radius is equal to the height of the rod.*" This law (which very considerably restricts the area protected) is based on the common-sense supposition that lightning will strike to the nearest conducting point. The old law laid down in the *first* report of the French Academy of Sciences, viz., that "the area protected by a conductor is that of a cone, the radius of whose base is twice the height of the rod," was most distinctly and emphatically stated to be entirely erroneous and baseless in the *second* report of the Academy; this latter report was issued in consequence of the numerous buildings which had been struck and which had been fitted with conductors in accordance with the instructions given in the *first* report. Referring again to Mr. Preece's article in the *Philosophical Magazine*, it is there stated, "It is evident also that every prominent point of a building should have its rod." With further reference to the thickness of the *main* conductors, it should be recollected that the lightning may strike one of the conductors furthest off from the main conductor, and consequently the length of the path it would have to traverse would be greater than that of the height of the house. The practice is almost invariably to employ copper strand for conductors, and though no doubt copper is a little expensive, it cannot become reduced in size by rusting as iron can, and it is, therefore, undoubtedly to be preferred to the latter metal for the *main* conductors at least, though the combination of iron and copper is not to be recommended from the electrolytic action liable to be set up between the two, and the consequent eventual partial destruction of the iron. For further information on the subject of lightning conductors, we would recommend our correspondent to refer to Mr. Anderson's excellent work on the subject, published by Messrs. Spon, of Charing Cross.—EDIT. TEL. JOUR.]

To the Editor of the TELEGRAPHIC JOURNAL.

SIR,—As "B." has sought your advice in reference to the best means of protecting his house, with the result of your recommending Messrs. R. S. Newall & Co. as the makers of "*the best conductors*," permit me to point out, in common fairness, for the benefit of "B." and others, that the firm whose advertisement looms so largely on your front page—Messrs. Johnson & Phillips—are, and have been, the manufacturers of conductors of a superior conductivity to the firm named above; as also "sole makers of Vyle's patent easily tested lightning conductors," which, in a discussion before the Cleveland Institution of Engineers, on the 7th of November, was referred to as "the first scientific lightning conductor" ever invented. You were good enough to bestow a full-page illustration to it this year, and it has been most favourably noticed in *Chambers' Journal* for October and *Cassell's Family Magazine* for the present month, the *Builder*, *Iron*, &c. Ninety-six per cent. of pure copper is guaranteed, and the ability to test the conductor at any time after erection is secured at a cost of not more than the cost of other kinds.

Yours respectfully,

58, Glo'ster Road, N.W. C. C. VYLE.

20*th Dec.*, 1881.

[The conductivity of the conductors supplied by Messrs. Newall is 93 per cent. that of pure copper: the difference between this and 96 per cent. is certainly so trifling that no account need be taken of it; indeed, the difference would have to be considerably greater to render it worth while being taken into consideration. Although Mr. Vyle's patent conductors are very excellent of their kind, and for chimney shafts and lofty buildings are, in our opinion, the very best form to employ, we think their value may be exaggerated; and that for a two-storey country house (which we imagine that of "B." to be) the ordinary form of conductor is quite as efficient, and as easily tested, as Mr. Vyle's, while it must be less expensive. We do not doubt but that *Chambers' Journal*, *Cassell's Family Magazine*, the *Builder* and *Iron*, have spoken favourably of Mr. Vyle's invention; and though we quite admit that their opinions in the main are correct, we are not aware that they can be considered as authoritative in the electrical world.—EDIT. TEL. JOUR.]

THE INVENTION OF THE SPEAKING TELEPHONE.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—The inclosed is a translation from an article published in the *Fanfulla*, of Rome, which, if true, shows that a speaking telephone was made in 1865—about eleven years before Professor Bell produced his invention. I have sent to Italy to obtain copies of the Italian papers mentioned in the letter of Professor Farinet, and shall send them to you so soon as I shall receive them. There are two other claimants, both in the United States, for the honour of being first inventors of the telephone. One of these claimants, Mr. McDonough, has lately obtained a patent from the United States Patent Office, on his application filed 1867. Another claimant is Daniel Drawbaugh, who has the affidavits of one hundred and fifteen respectable persons to the fact that he had a speaking telephone in actual use in 1870. This matter is now before the United States courts, and we may expect soon to have their decision as to who is the *first* inventor of the telephone.

London, Yours,
Dec. 28, 1881. W. C. BARNEY.

The *Fanfulla*, of Rome, of January 30th, 1878, contains the following communication:—

"For some weeks past our Press has given descriptions of a stupendous, wonderful, and incredible invention, the transmission of sound by the telegraph—the telephone.

"There are only words of laudation in our journals for the inventor of this ingenious machine, but no one raises his voice to record the fact that eighteen years ago the Press published accounts of a similar invention by a native of Val d'Aoste, the mechanic Manzetti. We read in the *Petit Journal*, of Paris, of November 22nd, 1865, under the title, 'Curiosities of Science,' the following article:

"'Discovery of the transmission of sound and words by the telegraph.—A new discovery, which will work immense results in the application of it that can be made to the arts and industries, has not long been added to the number of wonders of this century; it is the transmission of the sounds of the voice by telegraph.

"'The author of this discovery is Signor Manzetti, of Aosta, the inventor, also, of a celebrated automaton. He transmitted words with the ordinary telegraph wire, and with an apparatus more simple than that which serves to-day for despatches. From this time henceforth two merchants may communicate instantaneously their business affairs from London to Calcutta, informing each other of their speculations, agreements, &c.

"'Numerous experiments have been made that have completely succeeded, and confirm the practicable possibility of this discovery. It transmits perfectly the sounds of music, &c.'

"The following other journals also publish statements relating to Manzetti's telephone:—

"The *Diritto*, of Rome, July 10th, 1865, gave a description of this instrument; the *Echo d'Italia*, of New York, August 19th, 1865; the *Italie*, of Florence, August 10th, 1865; the *Commercio d'Italia*, of Genoa, December 1st, 1865; the *Verita*, of Novari, January 4th, 1866; the *Commercio d'Genoa*, January 6th, 1866; the *Feille d'Aoste*, in various numbers.

"Manzetti was poor, and no one came to his aid.

"PROFESSOR FARINET."

NEW PATENTS—1881.

5430. "Telephones." A. W. ROSE. Dated Dec. 12.

5431. "Telephones." A. W. ROSE. Dated Dec. 12.

5432. "Telephones." A. W. ROSE. Dated Dec. 12.

5445. "Improvements in galvanic batteries, and in their application to electric lamps." O. C. D. ROSS. Dated Dec. 13.

5451. "Secondary batteries." J. PITKIN. Dated Dec. 13.

5452. "Improvements in apparatus to be used in connection with electrical batteries for charging the same and otherwise maintaining their proper working condition." W. R. LAKE. (Communicated by J. F. Aymonnet). Dated Dec. 13.

5460. "Fences, gates, and other like inclosures or closures, which improvements are also applicable to telegraph poles and similar supports." D. ROWELL. Dated Dec. 14.

5468. "Telegraph or telephone conductors." J. IMRAY. (Communicated by J. M. Stearns.) Dated Dec. 14.

5470. "Galvanic batteries." C. MAURIS. (Communicated by A. Thomas.) Dated Dec. 14.

5477. "Electric lamps, or lighting apparatus." W. R. LAKE. Communicated by C. F. de la Roche.) Dated Dec. 14.

5481. "Secondary batteries." D. G. FITZGERALD. Dated Dec. 14.

5490. "Electric lamps, or lighting apparatus." W. R. LAKE. (Communicated by J. A Mondos.) Dated Dec. 15.

5494. "Secondary voltaic cells." J. W. SWAN. Dated Dec. 15.

5499. "Improvements in measuring and recording electric currents, and in the apparatus employed therein." J. W. Swan. Dated Dec. 16.

5521. "Secondary or polarisation batteries for the storage of electric energy." G. GROUT. (Communicated by W. H. Jones.) Dated Dec. 17.

5524. "Improvements in electric lamps and in apparatus used in making them." R. KENNEDY. Dated Dec. 17.

5525. "Dynamo-electric machines." W. H. AKESTER. Dated Dec. 17.

5536. "Dynamo-electric machines and apparatus for electric lighting." J. E. H. GORDON. Dated Dec. 17.

5542. "An improved galvanic battery." W. R. LAKE. (Communicated by La Société Universelle d'Electricité Tommasi.) Dated Dec. 17.

5551. "Armatures for magneto-electric and dynamo-electric machines and motors." J. H. JOHNSON. (Communicated by W. W. Griscom.) Dated Dec. 19.

5566. "Means or apparatus for producing, storing, and conveying or transmitting electricity." A. MILLAR. Dated Dec. 20.

5573. "Telephones and telegraphs." W. R. LAKE. (Communicated by J. H. Rogers.) Dated Dec. 20.

5577. "Electric telegraphs." Sir J. ANDERSON and B. SMITH. Dated Dec. 20.

5593. "Dynamo-electric machines." L. S. POWELL. (Communicated by J. M. A. G. Lescuyer.) Dated Dec. 21.

5595. "Electric calls for telephone and analogous purposes." A. W. LAKE. (Communicated by W. C. Lockwood.) Dated Dec. 21.

5599. "Insulated conductors for telegraphic and other uses." W. SMITH. Dated Dec. 21.

5600. "Electric lighting apparatus for railway trains and other purposes" (generating electricity) (complete). S. PITT. (Communicated by E. T. Starr.) Dated Dec. 21.

5601. "Electrical brushes and combs." J. N. ARONSON. Dated Dec. 21.

5604. "Galvanic batteries for electric lighting and for other purposes." C. B. BURR and W. S. SCOTT. Dated Dec. 22.

5615. "Construction of cables or collections of metallic conductors for telephonic and telegraphic communication." J. M. CULBERTSON and J. W. BROWN. Dated Dec. 22.

5618. "A new or improved holder for incandescent electric lights." D. GRAHAM. Dated Dec. 22.

5627. "Electric call signals." H. J. HADDAN. (Communicated by G. W. Foster and F. B. Wilson.) Dated Dec. 23.

5632. "Construction of incandescent lamps." J. SELLON. Dated Dec. 23.

5656. "Improvements in apparatus for working electric clocks, and certain combinations of electric clock apparatus upon one and the same line, with devices for sending fire-alarm and other signals upon lines used for telephonic communication." E. G. BREWER. (Communicated by C. E. Buell.) Dated Dec. 24.

5660. "Electric lamps." L. S. POWELL. (Communicated by J. M. A. Gérard-Lescuyer. Dated Dec. 24.

5661. "Pipes or conduits for containing electrical conductors or wires." J. H. JOHNSON. (Communicated by C. Labye and L. de Locht Labye). Dated Dec. 24.

5665. "Improvements in apparatus for producing and regulating electric light, partly applicable to other uses." S. A. VARLEY. Dated Dec. 24.

5667. "Means or apparatus for the collection and distribution of electric currents." S. A. VARLEY. Dated Dec. 24

5668. "Improvements in apparatus for generating, regulating, and measuring electric current, and for lighting and for utilising them for lighting and performing mechanical work." Sir W. THOMSON. Dated Dec. 26.

5672. "An improvement in ship compasses, and the method of fixing and arranging and working such compasses to indicate and correct the local attraction in iron, steel, and other ships." R. EVANS. Dated Dec. 27.

5674. "Transmitting and receiving apparatus for type printing telegraphs." S. PITT. (Communicated by H. Van Hovenbergh.) Dated Dec. 27.

5681. "Construction and arrangement of dynamo-electric machines." J. RICHARDSON. Dated Dec. 27.

5687. "Means or apparatus for controlling and regulating the production and distribution of electricity." C. A. CARUS-WILSON. Dated Dec. 27.

5688. "Cymaphens, or apparatus for transmitting sound by electricity." C. F. VARLEY and F. H. VARLEY. Dated Dec. 27.

5693. "Improvements in electrical alarm apparatus for railway trains, to enable passengers to give an alarm to the guard or driver in case of necessity." D. S. GARAN. Dated Dec. 23.

5702. "Sockets or holders for electric lamps." J. W. SWAN. Dated Dec. 28.

5738. "Electric lamps." J. G. LORRAIN. Dated Dec. 31.

5743. "Electrical resistances." G. PFAMBUCHE and R. E. DUNSTON. Dated Dec. 31.

5751. "Apparatus for operating or controlling railway brakes by electricity." W. R. LAKE. (Communicated by A. L. Duvelius and others). Dated Dec. 31.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

913. "Machinery for twisting and lapping wire and other materials in the manufacture of ropes and cables." W. T. GLOVER and G. F. JAMES. Dated March 3. 6d. Relates particularly to improvements in the spindles and bobbins employed for twisting wires together in the manufacture of wire ropes, but is equally applicable to spindles for twisting or lapping wires or other required material round a central core, for instance, in insulating or covering telegraph wires, or for sheathing an internal rope or other core with wire or other continuous metal riband or other material. The improvements further relate to an improved arrangement of mechanism for stopping the machine fitted with our improved spindles in case of the wire or other material breaking or becoming exhausted.

1534. "Money tills with appliances for checking receipts of cash." FREDERICK HAWKINS. Dated April 7. 6d. Relates to certain improvements in money tills or cabinets with appliances for checking receipts of cash, and consists mainly of an apparatus in which are slots through which the coin received in payment is permitted to fall, and in falling to come in contact with studs or projections adjusted to the weight of such coin as to shift their position and establish an electrical connection through an armature and coil with a bell or other indicator, the coin then passing into a drawer or receptacle. The drawer is provided with an appliance, so that when being drawn out establishes electrical connection with a sound producing apparatus.

1809. "Telegraphic cables." W. R. LAKE. (A communication from abroad by Patrick B. Delany, of New York.) Dated April 26. 8d. The object of this invention is to produce for either underground or overground use a telegraphic cable, which will be practically unaffected by variations of atmospheric or earth temperature, and in which the conductors will be protected from the effects of moisture and electrical induction. The present invention consists mainly in protecting the electrical conductors from moisture by conducting heat by means of a suitable medium in sufficiently close proximity to said conductors to dissipate all moisture in their immediate vicinity and prevent its condensation upon them. The invention further consists in a telegraphic cable, in which the wires or conductors are surrounded by powdered talc packed tightly within a tube inclosing both it and the wires. This dry pulverised talc is not liable to be affected by variations of atmospheric or earth temperature, and therefore the cable will not be warped, or twisted, or ruptured by contractions and expansions of the insulating material.

1852. "Electric lighting apparatus." H. J. HADDAN. (A communication from abroad by Leon Somzée, of Brussels.) Dated April 29. 2d. The improvements consist in illuminating a flame of gas by passing therein and thereby an electric current, so that the passage of the current in the flame excites and transforms into luminous vibrations certain undulations of the gas flame. (*Provisional only.*)

1905. "Electro-telegraphic apparatus." J. H. THOMSON. Dated May 3. 2d. Relates to improvements in step by step electric telegraphs, and it has for its principal object to enable the needles or pointers to be rotated in either direction. (*Provisional only.*)

1918. "Manufacture of carbon conductors for incandescent electric lamps." E. G. BREWER. (A communication from abroad by Thomas Alva Edison). Dated May 3. 4d. The object of this invention is to furnish a method by which incandescent conductors can be made of graphite or plumbago, graphotoidal silicon, boron, and zirconium, and of allied substances, hereafter described.

1922. "Electric lamp." JOHN BANTING ROGERS. Dated May 3. 6d. The object of this invention is improved construction or arrangement of electric lamp, in which the carbons are fitted to adjust themselves either by their own weight or by an applied weight to bring the points or ends into electrical contact, the ends bearing upon or against an asbestos, talc, or other indestructible stem which is fixed to the body by which the carbons are held in position.

1942. "Electric arc lamps." JAMES BROCKIE. Dated May 4. 6d. Two solenoids or magnets are employed, one being placed in the main circuit, the other in a branch or shunt across the arc. The arc is first obtained by the direct action or pull of a magnet in the main circuit. The second magnet or solenoid which is in the shunt bridging the arc, releases, retards, or stops the feeding train; but at the same time the main magnet or solenoid tightens or slackens the spring against which the second solenoid acts, so that when a strong current exists in the main circuit, the main magnet in addition to directly enlarging the arc will pull or tighten the said spring, and when a weak current passes it will slacken the spring.

1950. "Electrophonic or telephonic apparatus." W. R. LAKE. (A communication from abroad by Louis Maiche, of Paris). Dated May 4. 6d. Relates to improvements in electrophones or telephonic apparatus, which according to the said invention are provided with multiple vibrating plates.

1968. "Electric-lighting apparatus." W. R. LAKE. (A communication from abroad by Nicolas Bouliguine, of Paris). Dated May 5. 6d. This invention is designed to provide an electric lamp or lighting apparatus which will be less expensive than those ordinarily employed, and simple in its arrangement.

2013. "Apparatus for generating and conveying electricity." AIME MASSON. Dated May 9. 2d. Consist in the application to dynamo-electric machines of an earth current for the purpose of regulating the path of electricity generated, combined with the application of dualised wires. (*Provisional only.*)

PROCEEDINGS OF SOCIETIES.

THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.

THE annual general meeting of this Society was held on December 15th, Professor CAREY FOSTER (President) in the chair. The minutes of the last ordinary general meeting having been read and confirmed, a ballot for the election of the new council for the present year was held, and the following gentlemen were elected:

President—Lieutenant-Colonel C. E. Webber, R.E. *Vice-Presidents*—Willoughby Smith, Professor W. G. Adams, F.R.S., C. E. Spagnoletti, M. Inst. C.E., Professor D. E. Hughes, F.R.S. *Hon. Treasurer*—E. Graves. *Hon. Secretary*—Lieutenant-Colonel Frank Bolton. *Council*—W. S. Andrews, William T. Ansell, Sir Charles Bright, M. Inst. C.E., C. B. Bright, the Earl of Crawford and Balcarres, F.R.S., H. G. Erichsen, H. C. Forde, M. Inst. C.E., Matthew Gray, John Fletcher Moulton, F.R.S., Alexander Siemens, Augustus Stroh, C. F. Varley, F.R.S. *Associate Members of Council*—Captain J. T. Bucknill, R.E., T. R. Crampton, M. Inst. C.E., C. H. B. Patey.

The annual report was then read by the Secretary (Mr. F. W. WEBB).

The total number of members of the Society was 1,039. During the year, 41 members had ceased to belong to the Society, owing either to deaths, resignations, or other causes. A list of the papers which had been read during the year was then given. The visit of Professor Helmholtz to England and the soirée given in his honour in the Flaxman Gallery of the University College, and the proceedings of the Society in connection with the Paris Exhibition, were next alluded to. As regards the financial condition of the Society, it was stated that the income had increased, whilst all liabilities had been paid off. The library had been considerably improved, by presents and purchases. The Society had, at the commencement of the year, adopted its new title, and the change had been beneficial. It was intended to register the Society under the Act of Parliament. After referring to the services rendered by the Honorary Secretary, in conclusion the report congratulated the Society on the position which it now occupied in the scientific world.

A report on the "Library" of the Society was next read. The library had been thrown open to the public generally, from four in the evening to eight o'clock. There had been 318 visitors during the year, of which number 168 were members and 150 non-members of the Society. Specifications of all the electrical patents were now supplied each week as they were published. The *United States Patent Journal* had been taken regularly since the commencement of the year. 140 additional papers and books had been added during the year. It might be remarked that one result of the Paris Exhibition had been that an Italian catalogue, largely drawn from the Ronalds catalogue, had been compiled. More in the way of book purchases might have been done if there had been more funds at disposal for the purpose.

At the conclusion of the reading of the reports,

Mr. MARTIN F. ROBERTS, in moving the adoption of the same, said that owing to the short notice given of the election of the council, it was almost impossble to do otherwise than elect those gentlemen who had been proposed by the outgoing council.

In reply the PRESIDENT said that this question had been considered by the council, and the existing arrangement had been considered by them to be a satisfactory one.

Mr. H. R. KEMPE suggested that a catalogue of the Electrical Patent Specifications might be compiled by the Society with advantage.

Votes of thanks to the Institution of Civil Engineers, to the Honorary Secretaries, &c., were then proposed and passed unanimously.

A paper was then read by Mr. C. F. VARLEY on "A convenient form of constant battery of very small resistance." This battery had been invented as long ago as 1854, and was of the well-known gravity form.

In the discussion which followed the reading of the paper Messrs. COFFIN, KEMPE, HIGGINS and AYRTON took part.

The meeting then adjourned.

CITY NOTES.

Old Broad Street, January 4th, 1882.

THE BRITISH AND IRISH TELEPHONE AND ELECTRIC WORKS COMPANY (LIMITED).

THE first ordinary general meeting of this Company was held on the 14th ultimo, at the Salisbury Hotel, Fleet Street, London, under the chairmanship of E. B. Bright, Esq.

The chairman, in the course of his remarks, said by reason of the comparatively moderate capital of the Company they were enabled to offer the public telephonic facilities on much lower terms than the existing telephone companies could do to yield any fair returns on their much larger capitals. He also stated that a satisfactory commencement of business had been made; but that, so far, the Postmaster-General had declined to grant the company licences for the establishment of telephonic exchanges, although the Company's terms to the public would only be about one-half the rates of the United Telephone and other companies, who had entered into a compact one with another to establish a monopoly, and to all of whom the Postmaster-General had granted such licences as this Company now seek to obtain.

The chairman also referred to the litigation pending with the United Telephone Company, which would be carried on to the bitter end in order to test the validity of the Bell, Edison, and Crossley patents.

Much dissatisfaction was expressed by the shareholders present at the action of the Postmaster-General, and it was moved by Mr. Gaskell, seconded by Mr. Parry, that this meeting express their surprise that the company's operations should be hampered by the withholding of the facilities for telephone exchanges afforded by the Postmaster-General to other companies and individuals, and that no reply or even acknowledgment has been received to the subsequent letters of the chairman to the secretary of the Post Office, dated the 8th and 30th November last. That, failing the receipt of a satisfactory reply from the Post Office by the 20th inst., it be an instruction to the Board to publish the correspondence, and to take such action, either by memorial to Parliament or otherwise, as may be deemed advisable.

These resolutions were put and carried unanimously.

It was reported that a very prominent position had been allotted to this company for its exhibits of railway telegraphs, telephones, and other apparatus at the forthcoming International Electric Exhibition at the Crystal Palace.

The retiring directors were then re-elected, and a vote of thanks to the chairman for presiding closed the proceedings.

THE ORIENTAL TELEPHONE COMPANY (LIMITED).

AN extraordinary general meeting of the members of the above Company was held on December 28th at the City Terminus Hotel, Cannon Street, for the purpose of considering a resolution approving and confirming a certain conditional agreement made, or intended to be made, between Alexander Graham Bell of the first part, Thomas Alva Edison of the second part, the Oriental Bell Telephone Company of New York of the third part, the Anglo-Indian Telephone Company (Limited), of the fourth part, George Edward Gouraud, Gardiner Green Hubbard, John Parks Bigelow, William Walter Cargill, and James Merril Ormes, of the fifth part, and this Company of the sixth part, whereby it was proposed to effect various modifications or alterations in the subsisting agreements, for the purchase by the Company of the properties and rights described in the agreement of January 25th, 1881, by reducing the amount of the consideration to be paid by this Company for such purchase. Mr. J. Pender, M.P., presided, and said that the bargain which had been made with the vendors in this undertaking had several omissions in it, but the vendors had met them in a very fair spirit, and the result was an addition of £10,000 in money to the value of the Company and £25,000 in shares. The directors of the Company, too, believed they had privileges superior to those of any other telephone company. They had the best field in India, but they were also to the front in Australia and other Colonial possessions. There were other areas beyond these in which the company could work. He called particular attention to the fact that though the nominal capital of the Company was £300,000 they were really working with £150,000. Their position when the Bombay, Madras, and Calcutta Exchanges opened would be a good one. Although the Company had not been established more than 15 months satisfactory arrangements had been made with the Indian Government. In Egypt they had the telephone opened, 50 subscribers being in Alexandria. In England alone they had enormous advantages. Their company had a vastly greater area for their operations without needing so much capital as others. They were richer, they should bear in mind, by £35,000 than they were when he previously adressed them. He would mention as an evidence of remarkable progress, that there were 175 subscribers in Honolulu, with a certainty of an increase in the number. The solicitor having read a resolution approving of the variations proposed, the chairman moved its adoption. Sir Julius Vogel seconded the motion, which was agreed to unanimously. In replying to a vote of thanks, the chairman said he would take the opportunity, as he was connected prominently with telegraph companies of saying that they had £25,000,000 under the sea in cables. His hands were perfectly full of business when he took up the telephone enterprise, but he felt that the telegraph and the telephone must combine, and that there was a great future before them. Before long they would be going hand in hand throughout the world. The proceedings then terminated.

WESTERN AND BRAZILIAN TELEGRAPH COMPANY (LIMITED).

IN the report for the past half-year the directors state that the total earnings amount to £116,391 5s. 6d., an increase of £5,458 4s. 9d. compared with last year, which showed an increase over 1879 of £18,199 6s. 4d. In addition to the ordinary revenue, £1,710 18s. 4d. has been recovered in law charges, and £780 3s. 4d. in the salvage of two vessels by the steamship Norseman, the total gross receipts being £118,882 7s. 2d., against £113,933 0s. 9d. for 1879-80. The working expenses for the year, including law charges, amount to £28,645 1s., as against £33,179 5s. 8d., a decrease of £4,525 4s. 8d. The maintenance for the year amounts to £41,807 9s. 3d., as against £41,849 2s. 3d. After paying the debenture interest and the loss incurred by the Company *re* Quintero collision, the balance remaining to the credit of the net revenue account is £18,074 12s. 2d., against £1,515 10s. 8d. for 1879-80. During the past year 188 knots of new main sheathed cable have been laid in substitution for a similar length of the old type. Two and a-half knots of shore end have also been renewed. The Board confirm the circular of the 4th of November last, relative to the compromise effected of the action recently instituted by the Company. On this account, up to the 30th of September last, £10,480 had been received in cash, and £3,800 nominal in shares, and since that date £96,851 16s. in cash, and £37,200 nominal in shares. A sum of £21,024 cash still remains outstanding, but is amply secured.

GREAT NORTHERN TELEGRAPH COMPANY.—On 19th December, 1881, we received intimation that this Company's cables between Amoy-Shanghai and between Amoy-Hong Kong were interrupted, thus isolating Amoy both from the north and the south. Telegrams for Hong Kong cannot therefore be forwarded by this Company's route, while telegrams for Amoy are fowarded by post from Shanghai. Until the restoration of the interrupted sections, this Company's line is the only available route to Shanghai and Japan. The Wladiwostock-Nagasaki cable of this Company was also interrupted on the 30th of December. Telegrams for China and Japan cannot therefore be accepted for transmission by this Company's route until further notice.

OPENING OF NEW TELEGRAPH STATIONS IN CHINA by the Great Northern Telegraph Company.—The telegraph land line from Shanghai to Tientsin having been completed, this Company are now prepared to accept messages for Soochow, Chinkiang, Tientsin, Chinkiangpoo, Chining, Lingching, and Taku. The fixed charge from this country to all these stations is 9s. 2d. per word. There is a daily mail between Tientsin and Peking, leaving Tientsin at 3 p.m. and Peking at 4 p.m. Time of transmission 24 hours. Postage 10d. per message.

DIRECT SPANISH TELEGRAPH COMPANY (LIMITED).—We are informed that direct cable communication with Spain, *via Bilbao*, is now fully restored.

THE INDIAN GOVERNMENT TELEGRAPHS.—The following letter has reference to a statement in our last issue :—

To the Editor of THE TELEGRAPHIC JOURNAL.

Sir,—In your "City Notes," dated the 12th inst., it is announced that the Indo-European Telegraph Company's cables between Bushire and Jask are interrupted. Will you kindly allow me to point out that the cables in question are not the property of the company mentioned, but of the Indian Government? They were interrupted on the 25th November, many hundreds of miles from Kurachi, where Mr. Mance, the engineer, and his staff are stationed, but communication was restored on the 4th December, two days before the notice of the break was issued by the Post Office. It is true that the Indo-European through line continues out of order, but this is owing to the interruption of the Norderney cable belonging to the Post Office, which, disabled some 30 or 40 miles from Lowestoft on the 28th October, has not yet been repaired. I am, sir, yours, &c.,

J. W. BATEMAN-CHAMPAIN,
Indo-European Government Telegraph Department, Lt.-Col., R.E.
London Office, 49 and 50, Parliament Street,
December 15th, 1881.

GLOBE TELEGRAPH COMPANY.—The directors of this Company announce interim dividends of 3s. per share on the Preference Shares, and 1s. 6d. per share on the Ordinary Shares, payable on the 18th instant.

EASTERN EXTENSION TELEGRAPH COMPANY.—The directors of this Company have declared an interim dividend for the quarter ending September 30th last of 2s. 6d. per share, or at the rate of 5 per cent. per annum, free of income-tax.

OWING to the fact that three weeks have elapsed since the last issue of this journal, the demand on our space is somewhat great. We therefore omit Quotations of Telegraph and Electric Light Companies' Stock, and also the usual list of Traffic Receipts, but these will be included in the future numbers in their usual positions.